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Towards an Understanding of Information
Technology and Organizational Change"**

Debra C. Gash and Wanda J. Orlikowski

MIT Sloan School Working Paper #3320-91-MSA

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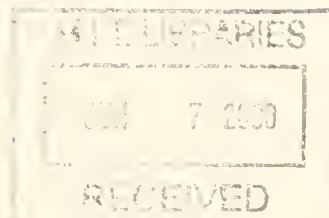
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CHANGING FRAMES

TOWARDS AN UNDERSTANDING OF INFORMATION TECHNOLOGY AND ORGANIZATIONAL CHANGE

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CHANGING FRAMES

TOWARDS AN UNDERSTANDING OF INFORMATION TECHNOLOGY AND ORGANIZATIONAL CHANGE

ABSTRACT

A framework, based on users' interpretations of technology, applies the notion of orders of organizational change to the implementation of information technology. This framework allows for the examination of intended and unanticipated modifications to interpretations and uses of information technology in organizations over time.

Information technology has often been thought of as an organizational intervention, designed to bring about desired changes (Kling and Scacchi, 1982; Markus, 1983). However, past literature has been largely unable to predict, let alone describe the complexity of changes that actually occur. Models of organizational change may be useful in helping to fill this void.

We find the notion of shared frames valuable for stimulating thought about the process and outcomes of information technology use in organizations. Specifically, we argue that one can examine patterns of organizational change occasioned by different types of technological interventions in terms of changes in technological frames over time. After presenting the conceptual apparatus of frames and types of change below, we will discuss a way of understanding technological change in organizations.

FRAMES

Recent literature in organizational behavior has applied the idea of individual organizing frameworks or schemata--borrowed from cognitive psychology (Bartlett, 1932; Neisser, 1976)--and extended it to groups and organizations (Calder and Schurr, 1981; Gray, Bougon and Donnellon, 1985). A variety of terms have been used to convey this idea of organizing mental schemata, including "paradigms" (Kuhn, 1970; Sheldon, 1980), "frames" (Goffman, 1974), "cognitive maps" (Bougon, Weick, and Binkhorst, 1977), "interpretive frames" (Bartunek and Moch, 1987), "interpretative schemes" (Giddens, 1984), and "mental models" (Carroll, 1985).¹ In general, frames direct perceptions and interpretations of organizational phenomena. They facilitate and constrain the scope of individuals' information search, provide a sense of what information is consistent or acceptable within a given frame, and inform individuals' action.

At the organization level, frames are typically implicit guidelines that organize and shape members' interpretations of events and give them meaning (Moch and Bartunek, 1990). To the degree that these interpretations are commonly shared (Smircich, 1983), some theorists argue they

¹ We will use the term "frames" in this paper to refer to this concept.

constitute elements of organizational culture. Schein (1987, 1988), for example, suggests that culture may be conceived of as the pattern of learned, taken-for-granted assumptions that are believed to be valid, and that are taught to new members as the correct way to perceive, think, and feel in relation to the problems of organizational performance, survival, and integration. It is important to note that while contrasting sets of assumptions may be held and are considered subcultures (Riley, 1983), dominant assumptions and interpretations tend to be fairly consistent and constitute the implicit paradigm under which many organizational members operate.

Most discussions of organizational frames do not address the issue of technology. As we will argue, it may not always be the case that the dominant assumptions about acceptable behaviors, environmental conditions, and other organizational activities embodied in general organizational frames “match” assumptions and understandings about how to design and use information technologies (Hinings and Greenwood, 1988). We hypothesize that it may be useful, at least theoretically, to distinguish between the general concept of organizational frames and the specific concept of technological frames. We briefly discuss the notion of technological frames below, after which we propose a framework for understanding technological change by mapping out changes in technological frames over time.

Technological Frames

Technological frames are subsets of organizational frames in that they are the assumptions, meanings, and cognitions that people use to understand the nature and role of technology in organizations. We derive this concept from the sociology of technology literature (Bijker, Hughes and Pinch, 1987) where it has a more general meaning, referring to the way members of a social group (not necessarily organizational) understand particular technological artifacts (Bijker 1987:172). Knowledge of a particular technology--which involves concepts, techniques, and local understanding of specific use in a given setting--is used by a social group in its interaction and problem-solving with a technology. Technology is interpretively flexible, that is, open to different interpretations by multiple social groups (Pinch and Bijker, 1987) who will construct different

technological frames or interpretations of the technology based on their interactions with it. For example, designers of an automobile can be expected to have different notions and knowledge of automobiles than drivers of automobiles, who in turn will have different interpretations to automobile mechanics, and so on. Technological frames of a particular technology may also vary over time or by context for a particular social group as members' experience or requirements change, e.g., automobile designers are also likely to be automobile drivers on different occasions.

Technological frames are powerful in that assumptions held about the function, value, and role of technology will strongly influence the choices made regarding the design or use of those technologies (Noble, 1986; Pinch and Bijker, 1987; Orlikowski, 1991). While a technological frame refers to a particular material technological artifact, it is distinct from the actual artifact (the actual hardware and software components) which cannot be understood and described without taking a social stance into account. Members of a particular social group may have a certain understanding of an artifact but their understanding represents only one view (theirs) of the technology (Orlikowski, 1991). Interpretations, to varying degrees, are shaped and constrained by groups' purpose, context, knowledge base, and the artifact itself. Because technologies are social artifacts, their material design and form embodies their developers' technological frames. For example, views of how work should be done, what the division of labor should be, how much autonomy employees and/or units should have, are all assumptions that are consciously or implicitly built into information technology by systems designers (Boland, 1979; Hirschheim and Klein, 1989; Orlikowski, 1991). Time too, affects the possibility of interpretation, as Pfaffenberger (1988:16) notes:

Once created, however, the opportunity for social choice diminishes. An implemented technology carries with it a powerful vision of the society in which it is to be used, replete with an equally powerful endowment of symbolic meaning and, sometimes, an obligatory plan for the way people will have to arrange themselves to use it.

Because organizational frames are often thought to reflect managerial interpretations of events and managerial values (Pfeffer, 1981), we shall consider the dominant organizational and technological frames as largely managerial. We argue that the technological frame held by

managers will tend to be the dominant one in an organization, and the one transmitted to users through training and socialization--even though this frame may differ from the frame held by systems designers or that reflected in the artifact. While the existence of multiple frames in organizations is gaining increased attention (Hinings and Greenwood, 1988; Moch and Bartunek, 1990), for purposes of preliminary exploration and parsimony we will focus primarily on dominant technological frames here. This model could easily be elaborated, for example, by considering the existence of multiple and/or conflicting frames (Bijker, 1987; Hinings and Greenwood 1988; Riley, 1983), the degree of tolerance or rigidity of frames with respect to new and possibly contradictory information, issues of varying commitment by participants to frames, and the extent to which frames are useful in explaining organizational realities (Schwartz, 1990).

ORDERS OF CHANGE

Casting organizational and technological frames as analytically distinct allows one to begin to theorize about the relationship between the two. For instance, it is possible to examine elements of dissonance or congruence between frames (Orlikowski and Gash, 1991), and to map out patterns of change among them. Our focus in this paper, however, is to consider only technological frames and examine differences in these frames over time as a way of understanding technological change. Despite variance in the attribution of causal agency across competing academic paradigms, it may be argued that the technological determinist, strategic choice, and emergent perspectives (Markus and Robey, 1988) all share at least some understanding of information technology as an organizational intervention. Given this, we can apply models of planned organizational change to information technologies to explore some preliminary thoughts about technological change.

Bartunek and Moch (1987) offer enhanced definitions of three types of change--first, second, and third order changes--by applying concepts from cognitive psychology to the understanding of organizational interventions. Actors in organizations may purposively intend organizational interventions to create either first, second or third order changes, while examination

of actual interventions suggests that there may be differences between the order of change intended or planned, and that which emerges (Goodman and Burke, 1982). We propose that the notion of orders of organizational change is a valuable tool in beginning to analyze the relationship between intentions and outcomes of information technology use.

Intentions for the design, adoption, and use of information technologies constitute actors' implicit and overt reasons for instigating and executing efforts to buy or develop, and implement information technology. Technologies cannot implement themselves, and human actors may be presumed to have at least minimal intentions for doing so. In dealing with intentions, one must address the issue of whose intentions are being considered. Drawing on a political model of organizational decision making (Allison, 1971; Pettigrew, 1973; Pfeffer, 1980; Markus, 1983), we argue that it is useful to start by focusing on the intentions of those aligned with dominant organizational and technological frames who have authority to approve plans, decisions, and resource allocations regarding information technologies.

We realize that by using the term intentions, we are implying allegiance with a strategic choice perspective, that is, with the view that technologies are planned interventions with certain anticipated outcomes. However, in addition to the effect of human choice, intentions, and compulsions (Noble, 1974), outcomes of technology implementation and use reflect factors beyond managerial control (Orlikowski, 1991). Our position is that it is the interaction between human actions, organizational contexts, and technological artifacts at particular points in time that produce various organizational outcomes, planned and unplanned.

In our framework, thus, we are not only interested in intended changes but also emergent or unanticipated consequences. In general, the literature on information technologies in organizations has considered unplanned changes as interesting side notes to the main event, or random error. Recently, however, some researchers have begun to focus specifically on the emergent, often subtle changes in organizational structures and social relationships that follow technological implementations (Barley 1986, 1990). When considering outcomes, we are not, at

this time, looking at detailed changes, but rather at general trends. More fine-grained analyses should be possible later within specific empirical studies.

INFORMATION TECHNOLOGY, TECHNOLOGICAL FRAMES, AND ORDERS OF CHANGE

Organizational interventions occasioned by the introduction of information technology can be understood in terms of changes in dominant technological frames over time (before and after the technological intervention). For each of the three types of change discussed below, we first examine its effects in terms of more general organizational frames, and then in terms of the special case of technological frames.

First Order Change

First order changes are changes intended to reinforce existing dominant frames. First order changes do not significantly change organizational frames, rather they incrementally modify current values, norms, interpretations, and processes. Thus, they essentially comprise organizational changes that make sense within an established mode of operating (Bartunek and Moch, 1987). First order changes presume the utility of established organizational frames, and serve to tacitly reinforce present understandings, including the status quo configuration of interests and interest groups (Bartunek and Moch, 1987).

Information Technology and First Order Change

In intended first order technological change, the dominant technological frame is reinforced as the artifact is modified to take into account incremental changes in operations. Implementors of intended first order technological change do not intend to radically alter the way of understanding or doing business, but rather wish to improve established operations through, for example, increasing productivity, efficiency, throughput, the handling of transactions, or through decreasing costs (Scott Morton and Rockart, 1984). Automation of existing tasks and processes creates information systems that reflect and reaffirm the organizational status quo, resulting in changes in

current practices and relationships that do not require radically different processes or structures. Classic examples of first order information technology changes are the early transaction processing systems built in the sixties, such as payroll systems and large accounts receivable or inventory systems, whose primary goal was to streamline high volume, highly routine paper processing work. First order change is not limited to transaction processing systems, however. Initial versions of electronic spreadsheets were developed simply to automate accountants' tedious manual calculations, not to transform them.

First order technological changes sometimes have consequences that exceed their implementors' expectations. For example, as automation efforts spread throughout organizations, and as hardware and software developments create opportunities for more complex and integrated systems, some of the effects of information technology implementations may be so widespread and so profound that they go beyond first order change. Even though managers may have planned to merely effect efficiency improvements, not intending to fundamentally alter assumptions, processes, tasks, roles, knowledge bases, and interactions with internal and external constituents, it is possible for unintentional discontinuous or second order changes to emerge. This may be due to a number of interacting factors including technological complexity, poorly understood scope of change, poorly trained users, and unanticipated opportunities. For example, airline reservation systems were initially intended to speed up the processing of airline ticket sales (first order change). No one could have predicted the wide-reaching and unanticipated changes that have resulted from the implementation of this information technology, such as the impact on the market and competitors, the new relations between the airline and travel agents as well as passengers, better information and process control for management, increased monitoring of reservation agents, the ability to sell computer services to competitors, the ability to link related services such as car rental and hotel reservations, and so on.

So far we have only been referring to the dominant managerial frames, and how technological change may exceed their first order intentions and perceptions. Clearly, other social groups may experience and interpret technological changes differently. For example, even when

managers and systems designers intend and perceive first order change in operations, payroll clerks may perceive automated payroll systems as a radical change in their work and social relations. In this case, the technological frame of the payroll clerks will be significantly different from that of the managers and designers, and their interaction with the technology must be understood--not as intended first order change viewed from the dominant technological frame--but as unintended second order change perceived through their technological frame.

Measuring first order technological change is relatively straightforward if the basic tasks and procedures have remained intact. In this case, the performance criteria constituting the dominant technological frames will still be appropriate after the technology is in place, and cost-benefit analyses along a set of defined measures can be conducted. For example, measures of productivity such as number of insurance claims adjudicated per day, before and after the introduction of a technology, can be compared to determine the change in performance afforded by the technology. When measuring first order change, researchers define measures of the before and after conditions by grounding them in the technological frames and processes of the *before* condition. However, where the technology has also inadvertently triggered unintended second order changes, the criteria employed by managers and researchers to measure first order change are unable to discern second order change (Golembiewski, Billingsley and Yeager, 1976). With second order change, assumptions and processes have been radically altered, and pre-defined measures that are associated with the dominant technological frames of the *before* condition cannot detect or assess this shift. New technological frames are needed--by both managers and researchers--to comprehend and evaluate the discontinuities in assumptions and processes implied by second order change. Unintended second order changes are typically more easily recognized and understood through indepth fieldwork which does not presume taken-for-granted technological frames, and allows for the emergence of new assumptions, meanings, and experiences. For example, some researchers using process-oriented, qualitative methodologies have reported unanticipated second order changes in organizations intending only first order change (Gash, 1987; Orlikowski 1988; Zuboff, 1988; Barley 1990).

Second Order Change

Second order changes go beyond augmenting or streamlining existing frames and processes, and involve shifting to radically different assumptions and mode of operation, with the shift reflecting a discontinuity and a replacement of the status quo. Bartunek and Moch (1987:6) define second order change as “the conscious modification of present schemata in a particular direction.” Indeed, much organizational transformation literature (Kimberly and Quinn, 1984; Hinings and Greenwood, 1988) has attempted to describe how “a system moves from one way of understanding significant aspects of itself to another” (Moch and Bartunek, 1990:12).

Information Technology and Second Order Change

In intended second order technological change, there is a discontinuous shift in the dominant technological frame (Tushman and Romanelli, 1985). This results in information technology which replaces the status quo with a new way of doing things, in contrast to first order change where the information technology reinforces the status quo. With second order technological change, existing assumptions, tasks, knowledge, processes, social relations, strategies, etc., no longer apply after the deployment of the information technology. While implementors of the information technology typically also intend to improve productivity or decrease costs, their primary aim is to change the established assumptions and mode of operating. The focus is on innovation, for example, to create new production processes, different products and services, to define new markets, forge new relations with customers, suppliers, and to enter into strategic partnerships with related players.

Examples of second order technological change are particularly evident in the information system implementations of the eighties, when managers attempted to use information technology strategically or for competitive advantage by radically redesigning old business processes (Ives and Learmonth, 1984; McFarlan, 1984; Davenport and Short, 1990; Hammer, 1990). Second order technological change may occur when users begin to notice that their current technology no longer meets information processing needs, in part because it no longer matches organizational

assumptions or environmental conditions. Huber (1984) and Scott Morton and Rockart (1984) note that multiple discontinuous changes in information technology are triggered by various environmental conditions, including increased complexity, turbulence and globalization.

Even though second order technological change involves deliberate radical breaking with past frames and processes, unintended organizational changes may still occur. Perrow (1983) shows how the increasing complexity of contemporary technological systems may cause operating error and failure because of implementors' inability to think through and test all the potential interactions that may occur. So too with second order technological change, it is possible that the new dominant technological frame, processes, and structure are poorly understood by workers who have been inadequately trained or who feel threatened by the transformation of their familiar structures, power bases, social relations, autonomy, and knowledge. Or the interdependencies in business processes may not have been fully understood, so that the new processes which had been thought to be self-contained, disrupt other parts of the organization creating tensions and conflicts. Unintended second order changes may also take the form of increased employee morale as a consequence of simplified processes or increased responsibility in jobs. Thus, various unanticipated second order changes can be expected to accompany intended second order change. And we can expect greater unanticipated second order changes than under first order change, because of the difficulties and discontinuities involved in shifting to new frames of reference.

Second order changes, unlike first order changes, pose measurement problems because frames and processes have been altered (Golembiewski, Billingsley, and Yeager, 1976; Armenakis and Zmud 1979; Armenakis, 1988). Mohrman and Lawler (1984:138) suggest that second order change "reflects changes in worldview and reality so that phenomena before and after change are not directly comparable. Not only might things be done in different ways because of the technology, but they might come to seem different in nature and therefore be evaluated in new ways." For example, where insurance claims processing has been automated, measuring workers' productivity by number of claims adjudicated per day may no longer be appropriate, as other features, which were not measurable in the before condition (such as quality of service and

customer satisfaction) may now be important components of the job. As mentioned above, qualitative fieldwork may be especially useful in detecting and assessing intended and unintended second order changes.

Third Order Change

Third order change is aimed at building the capacity for organizations to regularly identify and reflect on the assumptions, tasks, processes, relations, interactions, and structures currently in place, and to change them if appropriate. Morgan (1986:78) notes “Under changing circumstances it is important that elements of organization be able to question the appropriateness of what they are doing and to modify their action to take account of new situations.” Third order changes involve “the training of organizational members so they may be aware of their present schemata and thereby more able to change these schemata as they see fit” (Bartunek and Moch, 1987:6). Organizational change theorists have noted that future organizations must develop the self-diagnostic capacity to be aware of the perspectives from which they are operating in order to reassess the quality of their relationship with critical environmental contingencies (Argyris and Schon, 1978; Schein, 1988). This normative approach suggests that organizations become “self-designing” or “learning” via frequent, critical examination of key assumptions, processes, and structural decisions (Hedberg, Nystrom and Starbuck 1976, 1977; Senge, 1990). Third order change does not imply that all organizations must change continuously, but rather that they must be intermittently reflective and open to the increased appropriateness of alternative frames.

Third order changes have been rarely seen in practice, although they have been espoused by some organizational change theorists for years. The popular business literature is replete with calls for more and more discontinuous change in the form of rapid adaptation to rapidly shifting global markets. Clearly, more frequent paradigm or frame changes will also be necessary to allow organizational members the flexibility to regularly perform their work in newer, more appropriate ways, or to engage in different activities. How to accomplish this successfully remains a difficult and open question.

Information Technology and Third Order Change

Intended third order technological change requires a qualitatively different shift in the dominant technological frame. The shift does not require the adoption of new assumptions about the artifact and its use, but the acknowledgement of technological frames, and an understanding of their influence on systems designers in their creation and maintenance of the artifacts, and on users in their assimilation and use of the technology in their worklives. This recognition of the existence and role of technological frames in shaping technological artifacts and their use, establishes the need for mechanisms that monitor and question the assumptions underlying the dominant technological frame.

Third order technological results in information technology that is reflective. Such artifacts “understand” the assumptions under which they were built and are able to report to users when underlying assumptions no longer hold or are being violated routinely. In such situations, users should be able to adopt or create different technological artifacts that are more appropriate to the current situation. This capability requires flexible technological and organizational designs rather than rigid, cast-in-concrete systems. Rather than creating multiple specialized and stand-alone information systems, implementors construct flexible and powerful information technology infrastructures with multiple alternative modules and options, from which technological capabilities for particular conditions can be quickly constructed, assembled, and customized. Most information systems have helped significantly in fostering single-loop learning (Argyris and Schon, 1978), through the controls, performance monitoring, exception reporting, and information memory that these systems offer. Most do not have the capacity to support double-loop learning by questioning their own operating norms. Technology representing a third order change would do so by simultaneously mediating task execution and the monitoring of its built-in assumptions.

Despite increasing attention to more organic organizational forms capable of dealing with expected future environments (Huber, 1984; Malone, Yates and Benjamin, 1987; Drucker, 1988; Nolan, Pollack and Ware, 1989; Schein, 1989), information technology infrastructures have not

yet integrated the notion of third order change. Third order changes require flexible information technology that may be modified when necessary, as frequent paradigm shifts require frequent processual modifications. Third order technological changes require knowledgeable and responsible users who are capable of distinguishing when the current dominant technological frame and current technological capabilities no longer meet their needs, and be able to act to change the situation. Users will need to know what portfolio of technology-based options are available, how to utilize those options and tools, and which options to pick for the different situations they encounter.

To date, we have no practical examples of organizations having successfully attempted third order technological changes, and the implications of such changes must remain speculative. It is likely that both intended and unintended consequences will result from establishing organizational and technological mechanisms that force users and managers to examine and evaluate their underlying assumptions, values, and uses of the technology.

IMPLICATIONS FOR RESEARCH AND PRACTICE

This paper has proposed a way of viewing organizational change occasioned by implementations of information technology in terms of technological frames and orders of change. The framework proposed here examines change in terms of modifications to the dominant technological frame, analyzing intentions, planned effects, as well as the unintended consequences for different social groups.

One of the issues raised by introducing the notion of technological frames is the relationship between intended and unintended changes in frames. Managers may need to be more sensitive to the order of change they are intending with the introduction of technology, so as to be able to understand how different constituencies affected by the technology may react to it. Focus groups and interviews may be useful in eliciting others' assumptions about the purpose, form, and use of technology.

We noted above that third order change appears to be quite difficult to achieve in practice. Greater awareness of the inevitability of change and better mechanisms may be needed to signal users when their information technologies are and are not meeting their requirements. It may be difficult to find an appropriate balance between the desire to have technology “disappear” and hence increase productivity, and the need to be cognizant of when technology is no longer useful or limiting in some way. Orlikowski (1988), for example, noted that users expressed the desire to have their information technology integrated seamlessly into their work, so that they would not have to think about using them.

With familiarity and carefully designed interfaces, information technologies recede from being perceptual figures to perceptual grounds. To use the common psychological analogy of the figure of an old woman/young woman, we can see that intended second order technological change requires switching from being able to perceive the old woman to discerning the young one. When users have assimilated technology into their work routines to this degree, it becomes figural only when it is not working, or when a discontinuous change--such as switching to new hardware or software--has occurred (Heidegger, 1962). For achieving efficient and effective performance in the short term, such technological transparency is valuable.

Notions of third order change, however, raise the question, how effective is this transparent use of technology in the long term? What happens in the future when that which is perceptual ground requires foreground attention? How easily can the change in perception and operation be accomplished? Third order technological change requires the ability to perceive both the old and the young woman, and to know when it is appropriate to see either one or both. Currently, the capacity to discern either figure, or both simultaneously, may have to rely more on personal or organizational mechanisms than technological ones. In the future, it is possible that technological developments will support the creation of “reflective” software.

Methodologically, the framework proposed here raises significant measurement issues. For example, it is necessary to be able to discern which order of change is intended, to then adequately measure the order of change that occurred, and to delineate the relationship between intended and

unintended changes. The bulk of the research on the relationship between information technology and organizations is variance oriented (Markus and Robey, 1988; Mohr, 1982). Researchers studying the outcomes of technological change have focused primarily on first order changes, postulating direct relationships between sets of variables. One might argue that by looking for planned, first order changes exclusively, researchers may have simply failed to note the unanticipated changes that also occurred. They also neglected the possibility of intended second or third order changes. The framework proposed here establishes the different orders of change that are possible and emphasizes the need to account for both intended and unintended changes. Second and third order changes are much more difficult to study than first order change, and there is much less of a research tradition here. Conventional quantitative research methods may be better suited to tracking first order changes, while qualitative methods employing process models may be better suited to identifying and tracking unplanned changes over time (Mohr, 1982). Triangulating on research approaches may be particularly useful here. For example, using a combination of qualitative and quantitative methods, Barley's (1986) study of the introduction of computerized scanning equipment to radiological work demonstrated intended first order changes in the nature and conduct of work, and unintended second order changes in interpersonal and occupational relationships and ultimately in organizational structure as new skill-based patterns of interaction became institutionalized.

Theoretically, the idea of technological frames opens up a wealth of research possibilities. Frames are particularly useful for describing changes in perceptions of technology and patterns of use that may reflect altered assumptions. The framework outlined above can be elaborated to examine conflicting technological frames or contradictions among organizational and technological frames, and thereby provide insight into the processes and outcomes of technological change. It might also be possible to postulate relationships between different intentions and the appropriate nature of change. Sheldon (1980), for example, suggests that first order change is relevant when the intended change is limited to a particular organizational dimension, but that this kind of adaptation may not be adequate when the process of adaptation involves many significant

organizational dimensions. In these cases, more radical paradigm shifts may be necessary. The framework might also allow researchers to tighten linkages between structural contingencies perspectives and processes of technological change. For example, first order change may be more appropriate when organizational environments are reasonably stable, whereas second or third order changes may be more relevant in turbulent and competitive environments. For example, Tushman and Romanelli (1985:177) describe how the relatively stable environment of ATT's regulated monopoly allowed it to flourish for almost a hundred years with only incremental changes, while the political, technological, and competitive changes of the 1980s forced it into a discontinuous or second order change.

We believe that the notion of technological frames and orders of change proposed here provides a unique and valuable framework for untangling the complex web of events, processes, and outcomes that occur when information technology is implemented in organizations.

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